

2008 Fish Operations Plan

BACKGROUND

The 2008 Fish Operations Plan (FOP) describes actions by the U.S. Army Corps of Engineers (Corps) to implement project operations for fish passage at its Federal Columbia River Power System (FCRPS) dams during the April – August 2008 fish migration season. This plan adopts the project operations contained in the 2007 FOP, as incorporated in the Court's May 23, 2007 Opinion and Order, through August 31, and modified through consensus during the 2007 migration season. Consistent with the 2004 Biological Opinion adaptive management strategy, water management and project operations for fish passage not addressed in this FOP will be consistent with the operations considered in the 2004 Biological Opinion and in particular, the 2008 Water Management Plan and 2008 Fish Passage Plan (FPP). Additionally, this plan incorporates operational adjustments necessary to perform essential research and to accommodate the installation or adjustment of surface bypass structures subsequent to the 2007 migration season. The structural modifications necessitating changes in operations are: (1) installation of a removable spillway weir (RSW) at Lower Monumental Dam; (2) installation of two prototype temporary spillway weirs (TSWs) at John Day Dam; and, (3) moving one of the two TSWs at McNary Dam to a different spill bay. In addition, the FOP describes operations during low flow periods and load swing hours which occurred in 2007 and were reported to the court. The following is a detailed description of the fish passage operations for the 2008 migration season.

SPRING SPILL OPERATIONS

Lower Snake River - spring spill will occur from April 3, 2008 through June 20, 2008 at Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams.

Lower Columbia River - spring spill will occur from April 10, 2008 through June 30, 2008 at McNary, John Day, and The Dalles dams and from April 10, 2008 through June 20, 2008 at Bonneville Dam.

Table 1 below summarizes spring spill and transport operations planned for each mainstem dam.

As in 2007, the Corps will manage spill levels to the total dissolved gas (TDG) saturation levels of 120% in the project tailrace and 115% in the forebay of the next project downstream, referred to as "gas caps" in this document. The project spill discharge level needed to meet but not exceed the gas caps is referred to as the "spill cap". Therefore, the spill cap is the maximum flow rate a project can spill for fish passage that does not exceed the gas caps. The gas caps (120% tailrace and 115% forebay) do not change for dams providing spill for fish passage in the spring and summer. Spill caps, on the other hand, may vary daily depending on flow, temperature, and other environmental conditions.

Table 1. Spring 2008 project spill levels and transport criteria.

Spring 2008

	Planned Operations for Spring 2008 (Day/Night)	Comments
Transport	Initiate transport at Lower Granite Dam between April 20 – May 1 with staggered transport start dates at Little Goose and Lower Monumental. Criteria for start date and stagger days will be provided to TMT *1	Same as 2007
Lower Granite	20kcfs / 20kcfs	Same as 2007
Little Goose	30%/30% Allow for 14 days night Gas Cap spill within the last week of April – second week of May (April 22 – May 15)*. Dates of actual night time spill to be determined by salmon managers within the window of time identified above	Same as 2007
Lower Monumental	gas cap / gas cap (approximately 27 kcfs day/night)	Same as 2007 test program (24 hr gas cap spill), with RSW installed
Ice Harbor	30%/30% vs 45kcfs/gas cap	Same as 2007
McNary	40%/40% (April 10 – June 30)	Same as 2007 for continued prototype temporary spillway weir (TSW) tests
John Day	0 / 60% on non-test days; 30%/30% or ~40%/40% on test days (~April 20 – June 20)	Same as 2007 on non-test days. TSW tests with 24 hour spill planned for 2008
The Dalles	40%/40%	Same as 2007
Bonneville	100kcfs/100kcfs	Same as 2007

*1 Initiation of Transport

* The timing of the 14 days of spill to nighttime gas cap levels will be determined in-season through the TMT processes and is intended to coincide with the peak of the wild spring yearling Chinook migration at Little Goose Dam within the window specified.

SUMMER SPILL OPERATIONS

Lower Snake River - summer spill will occur from June 21, 2008 through August 31, 2008 at Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams.

Lower Columbia River -summer spill will occur from July 1, 2008 through August 31, 2008 at McNary, John Day, and The Dalles dams and from June 21, 2008 through August 31, 2008 at Bonneville Dam.

Table 2 below summarizes summer spill operations planned for each mainstem dam.

As in 2007, the Corps will manage spill levels to the TDG saturation levels of 120% in the project tailrace and 115% in the forebay of the next project downstream, referred to as “gas caps” in this document. The project spill discharge level needed to meet but not exceed the gas caps is referred to as the “spill cap”. Therefore, the spill cap is the maximum flow rate a project can spill for fish passage that does not exceed the gas caps. The gas caps (120% tailrace and 115% forebay) do not change for dams providing spill for fish passage in the spring and summer. Spill caps, on the other hand, may vary daily depending on flow, temperature, and other environmental conditions.

Table 2. Summer 2008 project spill levels.

Summer 2008

Project	Planned Operations for Summer 2008 (Day/Night)	Comments
Lower Granite	18 kcfs / 18 kcfs	Same as 2007
Little Goose	30% / 30%	Same as 2007
Lower Monumental	17 kcfs / 17 kcfs	Same as 2007
Ice Harbor	30%/30% vs 45kcfs/gas cap	Same as 2007 test program
McNary	40%/40% vs 60%/60%	Same as 2007 test program
John Day	30% / 30% on non-test days; 30%/30% or ~40%/40% on test days (~June 21 – July 20)	Same as 2007 on non-test days. TSW tests with 24 hour spill planned for 2008
The Dalles	40%/40%	Same as 2007
Bonneville	85 or 75kcfs / gas cap (approximately 120 kcfs at night)	Same as 2007 test program

General Guidance for 2008 Fish Operations

For planning purposes, the Corps’ 2008 FOP operations for fish passage assume “average” run-off conditions. However, actual run-off conditions may be higher or lower than average, requiring adjustments in spill levels (kcfs discharge rates, spill percentages, or spill caps) to avoid or minimize poor juvenile or adult fish passage conditions or powerhouse constraints.

Therefore, actual spill levels may vary from the tables above. In addition, spill levels may require adjustments for the following reasons:

- TDG is managed daily in response to changing conditions. Adjustments will be made to manage the spill operation consistent with the states' 2007 TDG saturation limits of 120% tailrace and 115% forebay for fish passage.
- Power system and other project emergencies, including unplanned/unanticipated facility maintenance or outages, may necessitate temporary adjustments in accordance with established protocols.

The following sections describe the processes for spill management during high and low runoff conditions, TDG management, spillway operation, minimum generation, specific spring and summer operations for fish passage for each mainstem project, juvenile fish transportation program operations, protocols for emergencies, and reporting.

Spill Management

The Corps will initiate spill at 0001 hours, or shortly after midnight, at each of the projects on the start dates specified above. Spill caps will be established at the specified amounts and will continue unless conditions require changing to maintain TDG within the states' 2007 limits of 120% in the tailwater of a dam and 115% in the forebay of the next project downstream (and at Camas/Washougal). Spill will terminate at 2359 hours, or shortly before midnight, at each project on the end dates specified above.

The spill rates represented in Tables 1 and 2 assume average runoff conditions; however, actual conditions may require adjustments to these spill rates. Actual spill rates may increase above the specified rates for several reasons:

1. high runoff conditions where flows exceed the powerhouse hydraulic capacity with the specified spill rates;
2. generation unit outages that reduce powerhouse capacity;
3. power system or other emergencies that reduce powerhouse discharges; and,
4. a lack of power load resulting in an increase in the rate of spill.

Spill below the specified rates could occur during low runoff conditions when meeting minimum generation levels at a project requires reducing spill rates. This would most likely occur in late July and August. Minimum generation and spill rates are included below in the project specific information. Spill also may be reduced to accommodate navigation issues or other exigencies.

To make adjustments in response to changes in conditions, the Corps will utilize the existing Regional Forum committees. Changes in spill rates when flow conditions are higher or lower than anticipated will be coordinated through the regional forum Technical Management Team (TMT). This could include potential issues and adjustments to the juvenile fish transportation program. Spill patterns and biological test issues that have not been coordinated to date will be coordinated through the Corps' Anadromous Fish Evaluation Program (AFEP) subcommittees, which include the Studies Review Work Group (SRWG), Fish Facility Design Review Work Group (FFDRWG), and Fish Passage Operations and Maintenance Coordination Team (FPOM).

Total Dissolved Gas Management

In order to manage gas cap spill rates consistent with the states' 120%/115% TDG limits for fish passage spill used in 2007, the Corps' Reservoir Control Center (RCC) establishes the spill caps for each project on the lower Columbia and Snake rivers on a daily basis throughout the fish passage season. These spill caps are set so that resultant TDG percent saturation levels are not expected to exceed the 120%/115% TDG limits, measured as an average of the highest 12 hourly readings each day as was done in 2007. Within any given day, some hours of measured TDG levels may be higher or lower than the gas caps due to changing environmental conditions (wind, air temperature, etc). The process of establishing daily spill caps entails reviewing existing hourly data at each dam (including flow, spill, temperature, and TDG levels) and taking into consideration a number of forecast conditions (including total flow, flow through the powerhouse, wind and temperature forecast, etc.). This information is used as input into the SYSTDG (System TDG) modeling tool. The SYSTDG model estimates TDG levels in the rivers several days into the future and is a tool integral to daily decision-making when establishing spill caps at individual dams.

SYSTDG output is used to guide decisions to establish spill caps at each dam to avoid exceedances of the gas caps. However, during the spring freshet when flows are expected to be greater than hydraulic capacity with the specified spill rates at the dams, or if a lack of power load results in an increase in the spill rate, the Corps will attempt to minimize TDG on a system-wide basis. In this case, spill caps are also developed for 125%, 130%, or 135% saturation to minimize TDG throughout the system.

Spill caps set by RCC in daily spill priority requests will be met at the projects by using the spill pattern in the appropriate FPP spill table which most closely corresponds to the requested spill, either over or under the spill request. Spill caps will be adjusted on a daily basis as needed to avoid exceeding the gas caps. Operations to manage TDG will continue to be coordinated through the TMT.

Spillway Operations

Actual hourly spill quantities at dams will be slightly greater or less than shown in Tables 1 and 2. The Action Agencies will meet the requested spill levels to the extent possible, as described in Table 3. However, actual spill levels depend on the precision of spill gate settings, flow variations in real time, varying project head (the elevation difference between a project's forebay and tailwater), and other factors. Operations considerations are as follows:

Spill discharge rates: Due to limits in the precision of spill gates and control devices, short term flow variations, and head changes, it is not possible to discharge exactly the spill rates stated in the Tables 1 and 2, or as stated in RCC spill requests to projects that call for specific spill discharges. Therefore, spillway gates are opened to the settings in FPP spill pattern tables which provide discharges that are the closest to the agreed upon spill discharge rate. The spill rates in Table 3 coincide with specific gate settings in the FPP spill tables. Actual spill may be higher or lower than the identified spill rate.

Spill percentages: Spill percentages are considered target spill levels. The project control room operator and BPA duty scheduler calculate spill rates to attempt to be within +/- 1% of the target percentage for the following hour (Table 3). These percentages may not be attained due to low flow conditions, periods of minimum generation, when spill caps limit spill amounts, when spill is curtailed for navigation safety, and other circumstances. Operators and schedulers will review the percentages achieved during the day and adjust spill rates in later hours, with the objective of ending the day with a day average spill that achieves the target.

Minimum Generation

The Corps has identified minimum generation flows derived from FPP tables which specify turbine operation within the 1% of best efficiency range. These figures are approximations and do not account for varying head or other small adjustments that may result in variations in the reported minimum generation flow and spill amount. Conditions that may result in minor variations include:

1. Varying pool elevation: as reservoirs fluctuate within the operating range, flow rates through the generating unit change.
2. Generating unit governor "dead band": the governor controls the number of megawatts the unit should generate and cannot precisely control a unit; variations can be +/- 1% to 2% of generation.
3. System disturbances: once the generator is online and connected to the grid, it responds to changes in system voltage and frequency. These changes may cause the unit to increase flow and generation slightly within an hour.
4. Individual units may behave slightly differently or have unit specific constraints.
5. Generation control systems regulate megawatts (MW) generation only, and not flow through turbines.

All of the lower Snake River powerhouses may be required to keep one generating unit on line at all times for power system reliability. During low flows, one generator is run at the bottom of the 1% of best efficiency range. All of the Snake River plants have 2 "families" of turbines with slightly different capacities. In most cases one of the smaller units, with somewhat less generation and flow, will be online during these times. At the Snake River dams, the smaller units are generally numbered 1 – 3 and are the first priority for operation during the fish passage season. However, if smaller units are unavailable, one of the larger units may be used. Further, at Lower Monumental, generating unit 1, which is the first priority unit during fish passage, is damaged and cannot operate at the low end of the design range. However, because this unit is a fish passage priority TMT may recommend use of this unit, which will result in higher turbine discharge rates than shown in the Lower Monumental Summer Operation Considerations section below. In addition, Ice Harbor units cannot be operated at the lower end of the 1% of best efficiency range. These units experience cavitation at a generation level somewhat higher than the lower 1% limit, which damages the turbine and can be detrimental to fish. Therefore, Ice Harbor units will operate at their lower cavitation limits, as in 2007.

Table 3. Comparison of 2008 spill levels in Tables 1 and 2 with operational spill levels at mainstem dams.

Season/Project	2008 Spill Levels in Tables 1 and 2	2008 Operational Spill Levels	Comments
Spring			
Lower Granite	20 kcfs day/night	20.4 kcfs	Will fluctuate due to project head changes
Little Goose	30% day/night	30% +/- 1% hourly; 14 nights at spill cap	Target* 30% as a day average; meet nightly spill cap for 14 nights
Lower Monumental	27 kcfs day/night (gas cap)	spill cap day/night	Meet spill cap daily
Ice Harbor	30% day/night vs. 45 kcfs day / gas cap night	30% +/- 1% hourly; 45.6 kcfs day / spill cap night	Target 30% as a day average; 45.6 kcfs will fluctuate due to head changes; meet nightly spill cap
McNary	40% day/night	40% +/- 1% hourly	Target 40% as a day average
John Day	0 day / 60% night (non-test dates); 30% & ~40% day/night (test dates)	60%, 30%, ~40% +/- 1% hourly	Target percentages as a nightly or day average
The Dalles	40% day/night	40% +/- 1% hourly	Target 40% as a day average
Bonneville	100 kcfs day/night	100 kcfs	Will fluctuate due to head changes
Summer			
Lower Granite	18 kcfs day/night	18.6 kcfs	Will fluctuate due to head changes
Little Goose	30% day/night	30% +/- 1% hourly	Target 30% as a day average
Lower Monumental	17 kcfs day/night	17.1 kcfs	Will fluctuate due to head changes
Ice Harbor	30% day/night vs. 45 kcfs day / gas cap night	30% +/- 1% hourly; 45.6 kcfs day / spill cap night	Target 30% as a day average; 45.6 kcfs will fluctuate due to head changes; meet nightly spill cap
McNary	40% day/night vs. 60% day/night	40% +/- 1% hourly; 60% +/- 1% hourly	Target 40% or 60% as a day average
John Day	30% day/night	30% +/- 1% hourly	Target 30% as a day average
The Dalles	40% day/night	40% +/- 1% hourly	Target 40% as a day average
Bonneville	85 or 75 kcfs day / 120 kcfs night	85.3 or 74.6 kcfs day / spill cap night **	85.3 & 74.6 kcfs will fluctuate due to head changes; meet nightly spill cap

* Target: Make best effort to meet a specified spill level through frequent monitoring, projections, and spill adjustments within the defined range of variation. This will occur for each project through analysis and coordination between the Corps and BPA.

** The Bonneville Dam summer daytime spill discharge rate will be 85 kcfs until approximately July 20 for testing, then 75 kcfs through August 31.

Low Flow Operations

Low flow operations on Lower Snake projects are triggered when inflow is not sufficient to provide for both minimum generation and the planned spill levels. In these situations, the projects will operate one unit at minimum generation and spill the remainder of flow coming into the project. As flows transition from higher flows to low flows, there may be situations when flows recede at a higher rate than forecasted. In addition, inflows provided by nonfederal projects upstream are variable and uncertain. The combination of these factors may result in instances where unanticipated changes to inflow result in forebay elevations dropping to the low end of the Minimum Operating Pool (MOP). Since these projects have limited operating flexibility, maintaining minimum generation and the target spill may not be possible on every hour.

Also during these low flow operations, additional flow that is passed through a dam as the result of navigational lockages becomes more apparent. This is because the volume of water needed to empty the navigation lock during periods of low flow is a greater percentage of the total flow than it had been earlier in the season. As a result, the official recorded spill percent through the spillway appears to be reduced since it does not include this volume of water needed to empty the navigation lock.

Dates to start transporting fish at the Snake collector projects will be advanced if the spring seasonal flows at Lower Granite Dam are projected to be less than 70 kcfs. In that case, transportation will begin on April 20 at all three Snake collector projects instead of a staggered start as planned when seasonal flows are expected to be 70 kcfs or higher. Transportation operations and research are described in the “Juvenile Fish Transportation Program Operations” section on pages 24 – 26 of this document. Spill for fish passage will be provided under all flow conditions.

Operations during Load Swing Hours

Project operations during load swing hours may result in not meeting hourly spill, mostly at McNary, John Day, and The Dalles dams. This occurs because projects must be available to respond to within-hour load variability to satisfy North American Electric Reliability Council (NERC) reserve requirements (“on response”). During periods of rapidly changing loads, projects on response may have significant changes in turbine discharge within the hour. Under normal conditions, within-hour load changes occur mostly on hours immediately preceding and after the peak load hours, while spill quantity remains the same within the hour, however, sometimes several hours after peak load hours the project may still be decreasing total outflow and generation faster than the corresponding spill decreases causing the percent spill to be slightly higher. These hours are referred to as “load swing hours.” Due to the high variability of within-hour load, these load swing hours may have a greater instance of reporting actual spill percentages that vary more than the +/- 1% requirement than other hours. On the days this occurred in 2007, the day or night-time average spill was within the FOP level of +/- 1% of the target spill.

Spring and Summer Operations for Fish Passage by Project

The following describes the spring and summer operations by project. Included in the description is planned research as considered in the 2004 Biological Opinion. The Corps, and the regional agencies and Tribes are interested in the continuation of project research studies under the Corps' AFEP. These studies have undergone review by the regional agencies and Tribes. The studies are intended to provide further information on project survival and assist the region in making decisions on future operations and configuration actions to improve fish passage at the Lower Snake and Columbia River dams.

Lower Granite

Spring Spill Operations April 3 – June 20, 2008: 20 kcfs (including approximately 6 kcfs from the RSW and 14 kcfs from the training spill) 24 hours/day with the Removable Spillway Weir (RSW) operating. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spring research operations: Normal spring spill patterns and rates as described in the FPP will be used. There will be no specific spill variations for testing.

Operation considerations:

- Unit 2 will be out of service until late September 2008. The powerhouse will operate with no more than 5 units on during the spring and summer spill seasons. A contract for fire protection installation will take one unit at a time out of service, starting in July and continuing through the summer.
- With one unit out of service, powerhouse capacity is about 85 kcfs. If total river discharge is greater than approximately 105 kcfs, then spillway discharge will be forced above RSW spill + training spill levels. This involuntary spill could result in gas cap exceedances. Lack of power load also could cause involuntary spill at higher total river discharges.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

Summer Spill Operations June 21 – August 31, 2008: 18 kcfs (including approximately 6 kcfs from the RSW and 12 kcfs from the training spill) 24 hours/day with the RSW operating. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Summer research operations: Normal summer spill patterns and rates as described in the FPP will be used. There will be no specific spill variations for testing.

Operation considerations:

- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such low runoff conditions occur, alternative spill operations at the dam will be coordinated through the TMT.
- Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% efficiency range and is needed for power system reliability. This generation will be controlled to approximately 81 – 83 MW at units 1 – 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 96 - 100 MW. This will result in turbine flows of approximately 11 kcfs – 12 kcfs at units 1 – 3 and 12.5 kcfs - 13.5 kcfs at units 4 - 6. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This condition may occur in early spring before the freshet and during the late summer period with low flow conditions.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

Little Goose

Spring Spill Operations April 3 – June 20, 2008: 30% spill 24 hours/day. In addition, allow for 14 nights of spill up to gas cap spill rates between April 22 and May 15. Nighttime spill hours are 1800 – 0600. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Adult passage will be studied throughout the spring spill period.
- Spring research operations: 30% spill 24 hour/day. Bulk and uniform spill patterns (2 or 3 patterns) will be tested. Final test conditions will be coordinated through the SRWG.
- Objectives of the biological test: The primary objectives of the spring and summer test will be to inform decisions on TSW placement and operation in 2009 to provide effective juvenile fish passage while allowing adult fish to pass. Radio tagged adult fish will be tracked in the tailrace and into the fishway under the various spill operations. No juvenile survival studies are planned for Little Goose during spring or summer 2008.
- Spill pattern during the biological test: The test spill patterns will be developed through ERDC modeling and in coordination with SRWG.

Operation considerations:

- In the 2005 summer spill period, adult passage was blocked when daytime spill levels exceeded 30%. Also, adult passage was impaired in May 2007 with a bulk spill pattern. The study is designed to determine the hydraulics causing the blockages. In order to discern cause of the poor adult passage conditions it is necessary to monitor fish during both good and poor passage conditions. Slower fish passage may occur a couple days each week. In-season reporting will allow treatments to be adjusted through SRWG and TMT adaptive management processes to meet the study objectives or to ensure good adult passage is maintained in the course of the season.
- In both spring and summer, day average flows in the lower Snake River near 30 kcfs can result in incompatible operations with Lower Monumental Dam and cause spill quantity fluctuations.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.
- The powerhouse capacity with all six units in service operating within 1% best efficiency is approximately 107 kcfs. However, Unit 6 is currently forced out of service with a ground fault. Indications are that the unit will remain out of service through the spring season. With 5 units operating, powerhouse turbine capacity within the 1% of best efficiency range is about 88 kcfs. If the total river discharge is greater than approximately 115 kcfs, then spillway discharge will be forced above the planned operation of 30% spill.
- Nighttime spill up to gas cap rates will be provided for 14 days between April 22 and May 15. The spill is intended to coincide with peak passage periods for wild yearling Chinook. The 14 spill days do not have to be consecutive. Actual dates will be determined through coordination with TMT.

Summer Spill Operations June 21 – August 31, 2008: 30% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Adult passage will be studied throughout the summer spill period.
- Summer research operations: 30% spill 24 hour/day. The spill patterns used in the spring will be continued in the summer. Final test conditions will be coordinated through the SRWG.
- Objectives of the biological test: The primary objectives of the spring and summer test will be to inform decisions on TSW placement and operation in 2009 to provide effective juvenile fish passage while allowing adult fish to pass. Radio tagged adult fish will be tracked in the tailrace and into the fishway under the various spill operations. No juvenile passage studies are planned for Little Goose during spring or summer in 2008.

- Spill pattern during the biological test: The test spill patterns will be developed through ERDC modeling and in coordination with SRWG.

Operation considerations:

- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.
- Minimum spill: During periods of low flow before the spring freshet and during the late summer period, there may be periods where spill quantities are so low that it creates tailrace conditions not advantageous to fish passage. If such flow conditions occur, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% efficiency range and is needed for power system reliability. This generation will be controlled to approximately 81 – 83 MW at units 1 – 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 100 - 104 MW. This should result in turbine flows of 11 kcfs – 12 kcfs at units 1 – 3 and 13 kcfs – 14 kcfs at units 4 – 6. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This situation may occur in early spring before the freshet and during the late summer period with low flow conditions.

Once the operations for research are completed, the spill patterns will return to normal operation as described in the FPP and to the spill levels as shown in the tables above.

Lower Monumental

Spring Spill Operations April 3 – June 20, 2008: Spill to the spill cap 24 hours/day. The estimated spring spill cap rate is 27 kcfs. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately May 1 – May 31. The dates of testing will be dependent on the size of fish and fish availability. Final dates for testing will be coordinated through the SRWG.
- Spring research operations: A two treatment test will be conducted, utilizing the bulk spill pattern from 2006-2007 versus the 2003 uniform (flat) pattern modified for the RSW in spill bay 8. Pattern changes will occur at 0600. However, if the runoff forecast is high, a one treatment study would be conducted as the higher the spill levels the more similar the two patterns become.

- Objectives of the biological test: The objectives of the study are to assess passage distribution and efficiency metrics, forebay retention, tailrace egress, and survival for yearling Chinook, and steelhead for two spill pattern treatments, a bulk spill pattern and a uniform pattern with the RSW. This will be the first year of testing of the RSW at Lower Monumental Dam.
- Spill pattern during the biological test: Spill patterns will be verified through ERDC modeling and SRWG coordination.

Operation considerations:

- In the spring and summer, day average flows near 30 kcfs results in incompatible operations with Little Goose Dam and results in spill quantity fluctuation.
- The Lower Monumental spill cap is affected by Little Goose Dam operations. Therefore, spill discharge could be lower than 27 kcfs.
- The removable spillway weir (RSW) was installed in October 2007 and will be tested in 2008.
- Spill will be reduced or stopped as needed to allow safe operation of fish transportation barges near collection facilities downstream of the project. Spill changes will be minimized in order to reduce effects on spill research.
- Operating units within the 1% of best efficiency range yields up to 19 kcfs per unit at each of the 6 units for a maximum hydraulic capacity of approximately 114 kcfs. The expected spill cap is 27 kcfs. Therefore, if total river discharge is greater than 141 kcfs the gas cap will be exceeded. Either lack of power load or unit outages can also cause forced spill above spill cap rates at higher total river discharges.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

During non-test periods, the spill patterns will return to normal operation as described in the FPP and to the spill levels as shown in the tables above.

Summer Spill Operations June 21 – August 31, 2008: Spill 17 kcfs 24 hours per day, subject to gas cap limits. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: June 21 – mid-July, or possibly earlier. The dates of testing will be dependent on the availability of Subyearling Chinook of sufficient size for tagging. Final dates for testing will be coordinated through the FFDRWG.

- Summer research operations: 17 kcfs 24 hours per day with one spill pattern treatment. The spill pattern will be the pattern used in 2006 and coordinated through SRWG. The 2007 pattern for navigation appeared to have lower fish survival than in 2006.
- Objectives of the biological test: Estimate passage distribution and survival for subyearling fall Chinook salmon under two spill pattern treatments.
- Spill pattern during the biological test: FPP spill patterns will be provided in February.

Operation considerations:

- As in the spring, the summer spill caps may be affected by Little Goose operations.
- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods when spill quantities are limited so that tailrace conditions are not advantageous to fish passage. This is interpreted to be a minimum of spill through the RSW only (6.8 kcfs with the reservoir operating at MOP). If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% of best efficiency range and is needed for power system reliability. This generation will be controlled to approximately 81 – 83 MW at units 2 – 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 104 - 106 MW on units 4 – 6, or 126 – 129 MW on unit 1 which has welded fixed blades. This will result in turbine flows of approximately 11 kcfs – 14 kcfs at units 2 – 6 and 17 kcfs – 19 kcfs if unit 1 is used. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This limit may occur in early spring before the freshet and during the late summer period with low flow conditions.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.
- A spill pattern or spill operation which will not adversely affect barge traffic and juvenile fall Chinook survival is still in development. During 2007 a spill pattern was developed with the assistance of the tow boat operators. However, survival of fall Chinook during 2007 was lower than that observed in 2006. A period of no spill during the time when barges approach the lock may be the best solution to balancing the needs of barge traffic and fish operations.

Ice Harbor

Spring Spill Operations April 3 – June 20, 2008: Alternate between 45 kcfs day/spill cap night and 30% 24 hours per day with the RSW operating, following a test schedule similar to that used in 2007. Nighttime spill hours are 1800 – 0500. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spring research operations: Normal spring spill patterns and rates as described in the FPP will be used. Radio tagged fish will be monitored to evaluate spill and project survival for two test conditions (single release model). Dates for 30% spill 24 hours per day will follow a schedule similar to that used in 2007, alternating every 2 days with 45 kcfs day / spill cap night in a randomized block design. This will start May 2 and continue through July 16. Spill will be 45 kcfs day / spill cap night before May 2 and after July 16. Both spill operations will have the RSW operating.
- Objectives of the biological test: The primary objective of the test is to determine spill and project survival under two spill conditions for yearling Chinook and steelhead.
- Spill pattern: FPP spill patterns will be used (FPP Tables IHR-9 and IHR-10).

Operation considerations:

- Powerhouse capacity at Ice Harbor is approximately 94 kcfs with all 6 units operating, while spill cap rates are about 100 kcfs. If total river flows exceed about 194 kcfs, TDG levels may exceed the limits set by the states of Oregon and Washington.
- Minimum generation or higher powerhouse operation will occur at all times during both the spring and summer fish spill seasons in 2008. This is due to a transformer failure at BPA's Sacajawea transmission facility near the project. Mobile capacitor groups will be installed at BPA's Franklin transmission facility to partially resolve power system issues. In addition, continuous generation is required at Ice Harbor Dam for power system stability and reliability.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

Summer Spill Operations June 21 – August 31, 2008: Alternate between 45 kcfs day/spill cap night and 30% 24 hours per day with the RSW operating through July 16, then spill 45 kcfs day / spill cap night through August 31. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Summer research operations: Continue 30% spill vs. 45 kcfs day / spill cap night through July 16, following a test schedule similar to that used in 2007. Both operations will have the RSW operating.
- Objectives of the biological test: The primary objective of the test is to determine spill and project survival under two spill conditions for subyearling Chinook.
- Spill pattern during the biological test: FPP spill patterns will be used (FPP Tables IHR-9 and IHR-10, same as spring).

Operation considerations:

- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. The minimum spill for Ice Harbor Dam is 15.2 kcfs, which includes providing spill through the RSW and training spill to ensure good tailrace egress conditions. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: The minimum generation amount represents the operation of one unit at the lower cavitation limit. The cavitation limit is within the 1% of best efficiency range. This generation will be controlled to approximately 65 – 70 MW at units 1 and 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 80 – 81 MW. This will result in turbine flows of approximately 9 kcfs – 10 kcfs at units 1 – 3 and 11 kcfs – 12 kcfs at units 4 – 6. Unit 2 has been modified by fixing the blades in a single position to eliminate an oil leak. As a result, its MW output and kcfs discharge at the low end of 1% will be higher than the other 5 units. Unit 2 is the last priority unit to operate and therefore is unlikely to operate to meet minimum generation. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This limit may occur in early spring before the freshet and during the late summer period with low flow conditions.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

McNary

Spring Spill Operations April 10 – June 30, 2008: 40% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately April 20 to early June (tentative). The dates of testing will be dependent on the size of fish, fish availability, and the number

of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Spring research operations: 40% spill 24 hours/day for the second year of prototype Temporary Spillway Weir (TSW) testing. One project spill configuration will be tested. Final test conditions will be coordinated through the SRWG.
- Objectives of the biological test:
 - Estimate passage and survival rates of yearling Chinook salmon under a single treatment of project operations.
 - Estimate passage and survival rates of juvenile steelhead under a single treatment of project operations.
 - Characterize juvenile salmon behavior in the forebay of McNary Dam under a single treatment of project operations.
- Spill pattern: As outlined in an addendum to the FPP. The Corps' Walla Walla District coordinated with regional fishery managers and evaluated new spill patterns with general model observations. Test spill patterns are provided in Appendix 1.

Operation considerations:

- TSW1 is placed in spill bay 19 (relocated from spill bay 22) while TSW2 remains in spill bay 20 for 2008 testing. This configuration was regionally reviewed and supported.
- During the periods when total river discharge exceeds approximately 320 kcfs, involuntary spill in excess of the states' TDG limits for fish passage, may occur.
- In addition, low power demand may also necessitate involuntary spill during any given spill treatment at total river discharges of less than 320 kcfs.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

Once research spill operations are completed, the spill pattern will return to normal operation as described in the FPP (Table MCN-6).

Summer Spill Operations July 1 – August 31, 2008: 40% spill vs. 60% spill 24 hours/day. Spill conditions will be alternated every two days. Spill changes will occur at 0600. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: approximately June 15 through July 25 (tentative). The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Summer research operations: 40% spill 24 hours/day vs. 60% spill 24 hours/day. Continue to evaluate TSW performance. The spill will be alternated in two day blocks which will be randomized during testing.
- Objectives of the biological test:
 - Estimate passage and survival rates of subyearling fall Chinook salmon under two treatments of project operations.
 - Characterize juvenile salmon behavior in the forebay of McNary Dam under two treatments of project operations.
- Spill pattern during the biological test: Spill pattern details were identified using the general model at ERDC by USACE Walla Walla District staff and representatives of the regional fisheries agencies and tribes. Test spill patterns are provided in Appendix 1. A single spill pattern will be tested at the 40% and 60% spill levels, using the 2006 spill pattern modified for placement of the TSWs in spill bays 19 and 20.

Operation considerations:

- Spill will be curtailed as needed to allow safe operation of fish transportation barges near collection facilities downstream of the project. Spill changes will be minimized in order to reduce effects on spill research. Specifically, the spillway, including TSWs in spill bays 19 and 20, will be closed while barges are crossing the tailrace (15 – 30 minutes per crossing). Gate hoists at spill bays 19 and 20 will be modified to allow closure with TSWs in place.
- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- If total river discharge drops below about 90 kcfs, 40% spill treatments may be reduced to maintain 50 kcfs powerhouse discharge. Similarly, if total river discharge drops below about 135 kcfs, 60% spill treatments may be reduced to maintain a 50 kcfs powerhouse discharge.
- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.

- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

Once research spill operations are completed, the spill pattern will return to normal operation as described in the FPP (Table MCN-6).

John Day

Spring Spill Operations April 10 – June 30, 2008: 0 kcfs spill day/60% spill night. Nighttime spill hours are 1800 – 0600 from April 10 through May 14 and 1900 – 0600 May 15 through June 30. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for prototype TSW testing: Testing in late April through early June. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.
- Spring research operations: Two prototype TSWs that pass about 10 kcfs spill each will be installed in spill bays 18 and 19. Training spill patterns to support the TSW jets and provide good downstream egress for juvenile salmonids are currently being developed by modeling at ERDC and coordination with regional agencies. Two spill levels will be tested to provide spill / TSW efficiency curves. These data will be used to design surface flow outlet and tailrace improvements at John Day Dam.
- Objectives of the biological test: The objectives of the study are to assess passage distribution and efficiency metrics, forebay retention, tailrace egress, and survival for yearling Chinook, and juvenile steelhead for two spill treatments. Also, prior to the smolt migration, a direct survival and injury test using balloon-tagged fish will be conducted.
- Spill pattern during biological test: 10 – 20 April, prior to the test, same as 2007 FOP except the spill pattern will be modified to use spill bays 1 – 17 only. Spill bays 18 and 19 will have the TSWs installed, which are not easily opened and closed. During 20 April to June 20, spill patterns for 30% and ~40% spill will be developed at ERDC in coordination with regional agencies.

Operation considerations:

- The hydraulic capacity for John Day is approximately 272 kcfs with all 16 units operating. If total river discharge exceeds this level, involuntary spill will occur during the daytime.
- If total river flow exceeds approximately 400 kcfs at night, 60% night spill levels would be 160 kcfs which may exceed TDG levels.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

Summer Spill Operations July 1 – August 31, 2008: 30% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: June 21 to approximately July 20. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.
- Summer research operations: Two training spill percentages, 30% and approximately 40%, will be tested.
- Objectives of the biological test: The objectives of the study are to assess passage distribution and efficiency metrics, forebay retention, tailrace egress, and survival will be estimated for subyearling fall Chinook.
- Spill pattern during the biological test: Spill patterns for 30% and ~40% spill will be developed at ERDC in coordination with regional agencies. Outside the test period, spill patterns described in the FPP with two TSWs in place will be used.

Operation considerations:

- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.
- If river flows drop below about 75 kcfs then spill may need to drop below 30% spill in order to maintain station service and power system needs.

The Dalles

Spring Spill Operations April 10 – June 30, 2008: 40% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill pattern during the biological test: No research is planned for 2008. The FPP spill patterns will be used. Spill patterns for high flows (450 kcfs or higher) are provided in Appendix 1.

Operation considerations:

- Spillway wire ropes at The Dalles Dam were replaced on Bays 1-9 in 2006. These bays are fully operational in 2008. Spill bays 10 – 22 can be operated in emergencies according to the table in Appendix 1.
- When high river flows exceed those shown in the table below such that available bays 1 – 9 cannot maintain 40% spill, FPOM and TMT will discuss the preferred spill pattern and rate. The project may maintain 40% spill of the total river flow and depart from the spill pattern, or spill less than 40% of the total river flow using a pattern other than that shown in the FPP. At no time is spill recommend on the south side of the spillway (Bays 14-22) as this creates a poor tailrace egress condition for spillway-passed fish.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.

Summer Spill Operations July 1 – August 31, 2008: 40% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill pattern during the biological test: No research is planned for 2008. The FPP spill patterns will be used.

Operation considerations:

- When high river flows exceed those shown in the table above such that available bays 1 – 9 cannot maintain 40% spill, FPOM and TMT will discuss the preferred spill pattern and rate. The project may maintain 40% spill of the total river flow and depart from the spill pattern, or spill less than 40% of the total river flow using a pattern other than that shown in the FPP. At no time is spill recommend on the south side of the spillway (Bays 14-22) as this creates a poor tailrace egress condition for spillway-passed fish.

- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.
- If river flows drop below about 90 kcfs then spill may need to drop below 40% spill in order to maintain station service and power system needs.

Bonneville

Spring Spill Operations April 10 – June 20, 2008: 100 kcfs spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately April 26 – June 7. The dates of testing will be dependent on the size of fish and fish availability. Final dates for testing will be coordinated through the SRWG.
- Spring research operations: 100 kcfs spill 24 hours/day.
- Objectives of the biological test: Estimate survival of yearling Chinook passing through the dam and spillway. Focus will be on new spill patterns to improve project spill survival.
- Spill pattern during the biological test: Spill patterns in the FPP will be used.

Operation considerations:

- Minimum spill discharge rate is 50 kcfs. This is to provide acceptable juvenile fish egress conditions in the tailrace.
- At spring flows less than 135 kcfs, spill will be less than 100 kcfs to maintain minimum powerhouse generation of 30 kcfs plus fish ladder and facility spill (e.g. corner collector).
- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.
- Actual spill levels at Bonneville Dam may range from 1 to 3 kcfs lower or higher than specified in the 2008 FOP. A number of factors influence this including hydraulic efficiency, exact gate opening calibration, spillway gate hoist cable stretch due to temperature changes, and forebay elevation (a higher forebay results in a greater volume of spill since more water can pass under the spill gate).

- The second powerhouse corner collector (5 kcfs discharge) will operate from early March to August 31, 2008. The March start date will be set to accommodate a passage study for migrating steelhead kelts and a potential passage study of juvenile fish released from the Spring Creek National Fish Hatchery. A 2-hour outage will occur the week of April 7 to remove research equipment.
- A 1-hour outage at spill bay 9 may occur monthly during the spill season to facilitate the use of Ground Penetrating Sonar (GPS) to measure and track erosion at spill bay 9 from inside the spillway inspection gallery. GPS data will be evaluated by Corps Portland District engineers to determine if a full spillway outage is required for a hydrographic survey. Such an outage occurred in 2007, but may not be needed in 2008 if GPS provides adequate monitoring data. The Corps will coordinate this work through FFDRWG, FPOM, and TMT.

Summer Spill Operations June 21 through August 31, 2008: 85 kcfs day from June 21 through approximately July 20, then 75 kcfs day for the remainder of the season through August 31. Spill to the spill cap at night. The estimated summer spill cap rate is 120 kcfs. Daytime spill hours change periodically and are defined in FPP Table BON-6. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: June 21 through approximately July 20. Continue tests of new spill patterns in the summer. Final dates for testing will be coordinated through the SRWG.
- Summer research operations: Daytime spill will be 85 kcfs until the end of the summer test, approximately July 20, after which the daytime spill will be 75 kcfs through August 31. Spill to the spill cap at night.
- Objectives of the biological test: Estimate survival of subyearling Chinook passing through the dam and spillway. Focus will be on new spill patterns to improve project spill survival.
- Spill Patterns for summer operations: Spill patterns in the FPP will be used.

Operation considerations:

- Minimum generation: A minimum powerhouse discharge of 30 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 30 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 30 kcfs for all hours.

- Unit outages will occur for required maintenance activities. The outage schedule for the project is shown in Appendix 2. Dates are subject to change.
- Minimum spill discharge level is 50 kcfs. This is to provide acceptable juvenile fish egress conditions in the tailrace.
- Actual spill levels at Bonneville Dam may range from 1 to 3 kcfs lower or higher than specified in the 2008 FOP. A number of factors influence this including hydraulic efficiency, exact gate opening calibration, spillway gate hoist cable stretch due to temperature changes, and forebay elevation (a higher forebay results in a greater volume of spill since more water can pass under the spill gate).
- The second powerhouse corner collector (5 kcfs discharge) will operate from early March until August 31.
- A full spillway outage may occur for several hours (up to 8 hours) in July 2008 for a hydrographic survey in the tailrace to measure erosion at spill bay 9. This survey may not be needed if the monthly GPS data are adequate to monitor spillway erosion. The Corps will coordinate this work through FFDRWG, FPOM, and TMT.

Juvenile Fish Transportation Program Operations

As noted above, the Corps' planned fish operations assume average runoff conditions. Based on collaborative discussion with the regional agencies and tribes, and as agreed to in 2007, the following explains the juvenile fish transportation program under all runoff conditions. The lower Snake River projects are described first, followed by McNary project operations. Detailed descriptions of project and transport facility operations to implement the program are contained in FPP Appendix B.

Lower Snake River Dams - Operation and Timing:

If the Snake River projected seasonal average (April 3 – June 20) flow is greater than 70 kcfs, the Corps will initiate transportation at Lower Granite Dam no earlier than April 20 and no later than May 1. The seasonal average flow projection will be based on the Corps' STP model and the April final water supply forecast for Lower Granite. The actual start date in 2008 will be determined through coordination with TMT as informed by the in-season river condition (e.g. river flow and temperature) and the status of the juvenile Chinook and steelhead runs (e.g. percentage of runs having passed the project). Also if the projected flow is greater than 70 kcfs, transportation will start 8 days and 11 days after the Lower Granite Dam start date for Little Goose and Lower Monumental dams, respectively. The actual start dates at Little Goose and Lower Monumental dams will be further considered through the TMT process, depending on in-season river conditions and the status of the juvenile Chinook and steelhead runs.

- a. Lower Granite: All ESBSs will be installed by March 25 and juvenile fish will be bypassed via normal separator operations and routed to the mid-river release outfall. All juvenile fish collected will be interrogated for PIT tags and normal 24-hour sampling for the Smolt Monitoring Program will take place.

b. Little Goose and Lower Monumental: All ESBSs and STSs will be installed by April 1 and juvenile fish will be bypassed via normal separator operations and fish will be routed to normal facility bypass outfalls. All juvenile fish will be interrogated for PIT tags and limited sampling may take place every 3 to 5 days to monitor fish condition. A full sample may be performed every other day to monitor species composition to help inform a decision on initiating transportation at these projects. At Lower Monumental, daily smolt monitoring will occur beginning April 1 and 100 steelhead will be PIT-tagged to assess avian prey selection. Also, study fish will be collected at Little Goose for the Lower Monumental passage and survival study.

In exceptionally low water years, when the projected seasonal average flow is less than 70 kcfs, the Corps will begin transportation on April 20 at all three Snake collector projects. Spill for fish passage will occur under all flow conditions.

April 20 – June 20: The collection of fish at lower Snake River projects for transportation will commence at 0700 hours on the agreed to start dates. Barging of fish will begin the following day and collected juvenile fish will be barged from each facility on a daily or every-other-day basis (depending on the number of fish) throughout the spring. Transport operations will be carried out concurrent with spill operations at each project and in accordance with all relevant FPP operating criteria.

June 21 – August 15: Transportation of juvenile fish from all three Snake River transport projects will continue on an every-other-day basis from June 21 through August 15, via barges.

August 16 – August 31: After August 15, trucks will be used for transporting juvenile fish from the Snake River collector projects on an every-other-day basis through August 31.

September 1 – Completion: Transportation of juvenile fish via trucks on an every-other-day basis will continue through October 31, 2008 at Lower Granite and Little Goose dams. At Lower Monumental Dam, transportation of fish via every-other-day trucking will continue through September 30, 2008.

McNary Dam - Operation and Timing:

Spring: Juvenile fish collected at McNary during the spring, April 1 through June 20, will be bypassed to the river. The normal operation will be to bypass fish through the full flow bypass pipe, which has interrogation capability to monitor for PIT tags. Every other day, however, in order to sample fish for the Smolt Monitoring Program, fish will be routed through the separator, interrogated for PIT tags, and then bypassed to the river.

Summer: When river conditions are determined to no longer be “spring like” as defined in the FPP and discussed at TMT, transportation of juvenile fish will begin if it does not significantly conflict with TSW operations. Collected juvenile fish will be barged every other day through August 16 unless they have been marked for in-river passage research. From August 16 through September 30, transportation will occur via trucks.

Other Planned Research

Juvenile Fish Transportation Research at Lower Granite Dam (three studies):

1. A study will be conducted to determine seasonal effects of transporting fish from the Snake River to optimize a transportation strategy. At Lower Granite, fish will be collected for this study starting on April 6, with marking beginning on April 7, 2008. Depending on the number of fish available, fish will be collected 1-2 days with tagging occurring on the day following collection. A barge will leave each Thursday morning with all fish collected during the previous 1-3 days. By barging all fish (minus the in-river group) during 1 to 3 days of collection, barge densities will be maintained at a level similar to what would occur under normal transport operations that time of year. This pattern will occur in the weeks preceding general transportation and will be incorporated into general transportation once that operation begins. The desired transported sample size is 6,000 wild Chinook and 6,000 wild steelhead weekly for approximately eight weeks.
2. A study to evaluate alternative barge release sites below Bonneville Dam has been underway for three years and will continue in 2008. The first barge for this study is tentatively scheduled to depart on April 21, and tagging of fish at Lower Granite on April 20 following collection on April 18 – 19.
3. A study will be conducted to evaluate latent mortality associated with passage through Snake River dams. The goal of this study is to determine whether migration through Snake River dams and reservoirs causes extra mortality in Snake River yearling (spring/summer) Chinook salmon smolts. Specifically, the study will determine if life-cycle survival downstream from McNary Dam is significantly higher for yearling hatchery Chinook salmon released into the Ice Harbor Dam tailrace than for counterparts which must pass three additional dams and reservoirs after release into the Lower Granite Dam tailrace. Fish will be collected at Lower Granite Dam beginning 20 April 2008 with the goal of tagging approximately 120,000 smolts, about 2/3 of which will be released into the tailrace of Lower Granite Dam, and 1/3 transported by truck and released in the tailrace of Ice Harbor Dam.

Avian Predation at Lower Monumental Dam:

A study will be conducted to evaluate the impacts of avian predation on salmonid smolts from the Columbia and Snake rivers. The study will determine how various biotic and abiotic factors are associated with differences in steelhead smolt vulnerability to predation by Crescent Island terns and Foundation Island cormorants. The study requests PIT tagging both hatchery and wild steelhead collected in the smolt monitoring sample at Lower Monumental and Ice Harbor dams, beginning April 1 and continuing through July. The recorded condition of a fish will be attached to a specific tag code and vulnerability to avian predation will be evaluated using PIT tag recovery data collected from the avian bird colonies. The study needs a minimum sample of 100 fish each day that are collected for condition by the smolt monitoring program.

Navigation Safety

Short-term adjustments in spill patterns or reductions in spill discharge rates may be required for navigation safety, primarily at the lower Snake projects but may also be necessary at the lower Columbia projects. This includes both commercial tows and fish barges.

Emergency Protocols

The Corps and Bureau of Reclamation will operate the projects in emergency situations in accordance with the Water Management Plan (WMP) Emergency Protocols (WMP Appendix 1). The Protocols define emergency conditions and situations that may arise while operating the FCRPS, and the immediate actions that may be taken in the face of the emergency. The Corps, BPA, and the Bureau of Reclamation are revising the Emergency Protocols in coordination with TMT. The most recent version of the Emergency Protocols is located at:

<http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2008/0926Ap1EmerActPlandrft.pdf>

Reporting

The Corps will prepare monthly (April – August) reports on the implementation of 2008 fish passage operations. The reports will include the following information:

- the hourly flow through the powerhouse;
- the hourly flow over the spillway compared to the spill target for that hour; and,
- the resultant 12-hour average TDG for the tailwater at each project and for the next project's forebay downstream.

The reports will also provide information on substantial issues that arise as a result of the spill program (e.g. Little Goose adult passage issues in 2005 and 2007). The reports also will address any emergency situations that arise.

The Corps will continue to provide the following data to the public regarding project flow, spill rate, TDG level, and water temperature.

- Flow and spill quantity data for the lower Snake and Columbia River dams are posted to the following website every hour:
<http://www.nwd-wc.usace.army.mil/report/projdata.htm>
- Water Quality: TDG and water temperature data are posted to the following website every six hours: <http://www.nwd-wc.usace.army.mil/report/total.html> These data are received via satellite from fixed monitoring sites in the Columbia and Snake rivers every six hours, and placed on a Corps public website upon receipt. Using the hourly TDG readings for each station in the lower Snake and Columbia rivers, the Corps calculates the highest 12-hour average TDG for each station. These averages are reported at:
http://www.nwd-wc.usace.army.mil/ftppub/water_quality/12hr/html/

Appendix 1

Test Spill Patterns

Special spill patterns for 2008 tests and high flow conditions are provided for Little Goose, Lower Monumental, McNary, John Day, and The Dalles dams.

Little Goose Dam:

The Corps will provide updated patterns for 30% tests.

Lower Monumental Dam:

The Corps will provide updated patterns for TSW tests.

McNary Dam:

The Corps will provide updated patterns for TSW tests.

John Day Dam:

The Corps will provide spill patterns for TSW testing.

The Dalles Dam:

The Dalles Dam, Special and Emergency Spill Operations, 2008 (and beyond). A total river volume greater than 450,000 cfs is possible that would require additional spillway flows. With Bays 10 – 23 out-of-service, the table below shows the special and emergency spill operations that are recommended at TDA in 2008 to safely accommodate higher flows.

Spill condition	Bays in use	Gate Opening (ft)	Spillway Q (cfs)	Powerhouse Q (cfs)	Total Q (cfs)
Normal, 40% BiOp Special spill	1-6 + 7-9	14 + 12	180,000	270,000	450,000
	1-9	14	189,000	270,000	459,000
	1-6 + 7-9	15 + 14	198,000	270,000	468,000
	1-9	15	202,500	270,000	472,500
	1-6 + 7 -9	16 + 15	211,500	270,000	481,500
	1-9	16	216,000	270,000	486,000
Emergency spill	Continue sequence	Continue sequence			
	1-9	30	405,000	270,000	675,000*
	1-9 + 14	30	450,000	270,000	720,000
	1-9 + 14-15	30	495,000	270,000	765,000
	1-9 + 14-16	30	540,000	270,000	810,000
	1-9 + 14-17	30	585,000	270,000	855,000
	Continue sequence to Bay 21	Max. of 30' opening			
	1-9 + 14-21	30	765,000	270,000	1,035,000
	1-9 + 12 + 14-21	30	810,000	270,000	1,080,000
	1-9 + 12+ 14-22	30	855,000	270,000	1,125,000
	1-9 + 12+ 14-23	30	900,000	270,000	1,170,000
	1-10+ 12 + 14-23	30	945,000	270,000	1,215,000
	1-12 + 14-23	30	990,000	270,000	1,260,000
	1-23	30	1,035,000	270,000	1,305,000

* Project discharge level at which the Corps may declare an emergency operation at The Dalles Dam to open spill bays 14 – 23.

Appendix 2

Schedule of Major Unit Outages

The following major outages are scheduled for the period April 1 through September 30, 2008. This schedule is based on the best information available at this time, but circumstances may arise which will necessitate adjustments to the schedule. It does not show all outages; shorter maintenance outages take place throughout the year. This schedule shows outages of longer duration with possible significant impacts to fish operations.

1. The schedule shown is for the four Lower Snake and four Lower Columbia projects for the period April 1 through September 30, 2008.
2. Where the description under the "Reason" column is preceded by an "F", this represents a forced outage. Estimated return to service dates are given and are the best guess at this time. Usually, the extent of the damage is not fully known.
3. Outage plans are not fully developed at this time. Some major work will depend on contracts which are not in place yet.

Project	Unit	Capacity (MW)	Out of Service Date		Return to Service Date		Reason
LWG	2	155	01/17/2006	0700	09/29/2008	2359	Liner Cavitation & Generator Rewind - Turbine Rehab/Testing
LWG	2	155	6/23/2008	0600	7/5/2008	1700	Main unit CO2 Fire Protection
LWG	4	155	07/07/2008	0600	07/31/2008	1700	Annual/PSS Install/Fire Protection
LWG	1	155	7/21/2008	0600	8/1/2008	1700	Main unit CO2 Fire Protection
LWG	5	155	08/04/2008	600	8/29/2008	1700	Annual/PSS Install/Fire Protection
LWG	3	155	08/04/2008	0600	12/19/2008	1700	Cavitation Repair/Air Cooler Replacement/Annual

LWG	6	155	09/02/2008	0700	09/26/2008	1700	Annual/PSS/Fire Protection
LWG	One	155	09/22/2008	0600	9/30/2008	1700	Commission New PSSs, Unit 4-6, One at a time
LGS*	6	155	12/11/2007	1500	10/1/2008	1700	F- Water leak caused field ground
LGS*	6	155	09/01/2008	0700	02/28/2009	1700	Spillway Deflector Ins. (Out as Needed)
LMN	1-6	930	09/08/2008	0700	09/08/2008	0800	Line Outage to take T1 OOS (Placeholder)
LMN	1-4	620	09/08/2008	0800	09/11/2008	1700	T1 Disconnect Work
LMN	1-6	930	09/11/2008	1700	09/11/2008	1800	Return T1 to service
IHR	6	127	10/01/2007	0000	3/28/2008	1700	F - HIGH gas readings
IHR	One	127	07/01/2008	0630	09/01/2008	1700	Main Unit Strainers
IHR	3	103	07/08/2008	0630	09/04/2008	1700	Overhaul
IHR	3-4	230	07/14/2008	0630	07/17/2008	1700	Doble Test TW 3, 4 Line 2
MCN	7	80	07/07/2008	0600	08/01/2008	1700	ETBOC
MCN	5	80	07/07/2008	0600	09/19/2008	1700	9-Yr Overhaul
MCN	1-2	160	08/04/2008	0600	08/06/2008	1700	T1 Doble Testing
MCN	5	80	08/04/2008	0600	08/29/2008	1700	ETBOC
MCN	8	80	09/02/2008	0600	09/26/2008	1700	ETBOC/Annual and Oil Indication
MCN	One	80	09/02/2008	1000	09/02/2008	1300	ESBS Insp
MCN	Three	240	09/08/2008	0600	09/13/2008	1700	Diving for Fish Studies
MCN	One	62	09/09/2008	1000	09/09/2008	1300	ESBS Inspections
MCN	4	80	09/15/2008	0600	09/19/2008	1700	Annual and Oil Indication
MCN	5-6	160	09/16/2008	0600	09/18/2008	1700	T3 Doble Testing
MCN	6	80	09/22/2008	0600	12/12/2008	1700	9-Yr Overhaul

MCN	11	80	09/29/2008	0600	10/24/2008	1700	ETBOC
JDA	16	155	04/16/2006	1630	02/29/2008	1700	F - kaplan linkage
JDA	10	155	05/25/2007	1730	02/29/2008	1600	F - field Ground/6 Year Overhaul
JDA	1,3	310	07/28/2008	0600	09/04/2008	1700	Overhaul
JDA	13-16	620	09/08/2008	0600	09/11/2008	1400	T4 Doble
JDA	9-10	310	09/15/2008	0600	10/23/2008	1400	Overhaul
JDA	5-8	620	10/20/2008	0600	10/23/2008	1400	T2 Doble
TDA	4	90	03/24/2008	0630	05/22/2008	1700	Cavitation Repair
TDA	22	100	05/27/2008	0630	07/31/2008	1700	5-Yr/Blade Cavitation, Seals/ Servo Motors
BON	8	60	09/12/2006	0750	05/15/2008	1600	Turbine Rehab
BON	7	60	06/04/2007	0750	12/25/2008	1700	Rehab Turbine, Stator
BON	1	48	10/23/2007	1551	02/14/2008	1600	F - Governor problems. wicket gate
BON	15	76	11/25/2007	2315	03/31/2008	1600	F - Rotor Pole Failure
BON	One	76	01/17/2008	1701	07/09/2008	1700	Excitor Repl - units 11-18, one unit at a time
BON	One	76	1/1/ 2008	0700	05/01/2008	1700	Fish guidance exclusion mods.
BON	3	56	04/14/2008	0700	05/30/2008	1700	PH 1 Unit five year o/haul, turbine obstructions
BON	9	60	07/01/2008	0700	12/20/2009	1700	U9 - Turbine rehab - Generator Rewind
BON	1	48	07/12/2008	0000	08/20/2008	1700	Five year o/haul, turbine obstruction, 300 G ins
BON	15	76	07/28/2008	0700	09/25/2008	1700	Cavitation repair
BON	Two	152	07/29/2008	0000	07/29/2008	1800	Collection Channel Dive, Brush Rigging, F1 & F2
BON	Four	304	08/04/2008	0000	08/07/2008	1700	T11 Bi/Annual Maint., Us 11 & 12 Annual, Install T11 Fault gas monitor, install sync PTs

BON	Four	304	08/11/2008	0000	08/14/2008	1700	T11 Bi/Annual Maint., Us 16 & 18 Annual, Install T12 Fault gas monitor, install sync PTs
BON	17	76	09/08/2008	0000	10/30/2008	1700	4 year overhaul

* Little Goose Dam: In addition to the Unit 6 outage, one unit at a time will be taken out of service for annual maintenance, starting July 28, 2008. Each outage will last approximately 3 weeks.